

Abstract

In a first aspect of the invention, different aspects of the packet header and data included in the packet are singled out for attention, rather than just the four byte IP destination address. This allows the M-trie Plus to perform functions that TRIES were unable to do. The current TRIE distinguishes only between the leaf and node type elements and is used only for routing. The M-trie Plus extends this and includes different information in the nodes of the trie which enables matching and branching on different header fields. The basic building block of all M-trie Plus nodes is an oppointer. The oppointer includes an address and an opcode. In a preferred embodiment, the address included in an oppointer is the address for the next node. The opcode included in an oppointer describes what action the router or switch has to do on the packet label to select the next oppointer leaf on the M-trie Plus data structure. If an oppointer points to the 8 bit termination leaf, the lookup is terminated. High speed packet header processing is achieved by the multiple pipelined threads of the M-trie Plus engine (MPE) and a wide memory bus. In a second aspect of the invention, the ACL of a configuration file in a router or switch is compiled into an ACL – M-trie Plus data structure which is located in the memory of the router or switch. This has the effect of merging routing and ACL processing in a single device. The M-trie Plus data structure 200 is traversed with respect to information included in the packet header, thereby determining whether a packet should be dropped or forwarded. ACL lists are defined in the configuration file of the router or switch. In a preferred embodiment, there are two forms of access list in the IOS:

1 the standard ACL and the extended ACL. Standard lists are used to control traffic based
2 on one or more source IP addresses. The extended access list provides a finer granularity
3 in controlling traffic. ACL definitions provide a set of criteria that are applied to each
4 packet that is processed by the router or switch. The router or switch decides whether to
5 forward or drop each packet based on whether or not the packet matches the access list
6 criteria. Typical criteria defined in ACLs are source addresses, destination addresses or
7 upper-layer protocols of the packet. In a third aspect of the invention, the M-trie Plus
8 structure 200 can map a multicast packet header by a sequence of nodes that match on
9 destination address or source address. Each physical port uses the M-trie Plus with the
10 first level nodes matching on the first 8 bits of the destination address, the second level
11 nodes matching on the second 8 bits of the destination address and so on, at each level the
12 nodes correspond to multicast addresses. In a preferred embodiment, the opcode included
13 in a node can specify other operations, such as instructions to compare bytes in the packet
14 header with bytes in a CAM (content addressable memory) or to direct certain types of
15 packets (for example, voice traffic) to a specified output interface.